

NOTES ON THE BIOLOGY AND DISTRIBUTION OF
 SPERCHOPSIS TESSELLATUS (ZIEGLER)
 (COLEOPTERA: HYDROPHILIDAE)

By PAUL J. SPANGLER¹

Four decades have elapsed since Richmond (1920) noted the habitat of *Hydrobius tessellatus* [= *Sperchopsis tessellatus* (Ziegler)] and briefly mentioned its larva. No additional biological information has been published about this species since that time. During the past few years, information on the life history of this beetle has been obtained by rearing the immature insects to the adult stage in the laboratory and by making supplementary observations in the field. Presentation of this information also affords the opportunity to include brief comments on the systematic status of this species and to present accumulated distribution records.

Acknowledgment is gratefully extended to the following institutions for the loan of specimens: Academy of Natural Sciences of Philadelphia; American Museum of Natural History; California Academy of Sciences; Canadian National Museum; Carnegie Museum; Cornell University; Illinois Natural History Survey; Ohio State University; United States National Museum; University of Michigan; and the University of Minnesota.

This species was originally described as *Spercheus tessellatus* by Ziegler (1844). In 1862, LeConte described a new monotypic genus, *Sperchopsis*, and cited *tessellatus* (sic) as the type species. In 1873, Horn transferred this species to the genus *Hydrobius*. Schwarz and Barber (1918) treated *tessellatus* as a *Spercheus*. In 1921, Knisch transferred this species to *Hydrocyclus* where it remained until 1928 when D'Orchymont restored *Sperchopsis*.

Generic status for *Sperchopsis tessellatus* is justified by numerous adult and larval characteristics that differ from other related hydrophilid genera. These larval characteristics are described in this study. An attempt also has been made to include a full synonymy for this species.

Sperchopsis tessellatus (Ziegler)

Spercheus tessellatus Ziegler, 1844, Proc. Acad. Nat. Sci. Philadelphia, 2:44.

Sperchopsis tessellatus, LeConte, 1862 (emended pages), Smithson. Misc. Coll., 3:47; Horn, 1873, Proc. American Philos. Soc., 13:113; Leng and Mutchler, 1927, Supplement to the Catalogue of the Coleoptera of America, North of Mexico, p. 19; D'Orchymont, 1928, Catalogue of Indian Insects, part 14, p. 93; Leng and Mutchler, 1933, Second and Third Supplement to the Catalogue of the Coleoptera of America, North of Mexico, p. 16; D'Orchymont, 1942, Mem. Mus. roy. Hist.

¹ Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C.

nat. Belgique, 23(28):20; Spangler, 1954, Ent. News, 65(5):116; Young, 1954, Univ. Florida Studies Biol. Sci. Ser., 5(1):172, 173.

Hydrobius tessellatus, Horn, 1873, Proc. American Philos. Soc., 13:133; LeConte and Horn, 1883, Smithson. Misc. Coll., 507:72; Wickham, 1895, Canadian Ent., 27:214; Ulke, 1902, Proc. U. S. Natl. Mus., 25(1275):9; Blatchley, 1910, Bull. Indiana Dept. Geol. Nat. Res., 1:263; Leng, 1913, Jour. New York Ent. Soc., 21:38; Leng and Mutchler, 1918, Bull. American Mus. Nat. Hist., 38:110; Richmond, 1920, Bull. American Mus. Nat. Hist., 42(1):55; Leng, 1920, Catalogue of the Coleoptera of America, North of Mexico, p. 84; Leng and Mutchler, 1927, Supplement to the Catalog of the Coleoptera of America, North of Mexico, p. 19; Löding, 1945, Geol. Surv. Alabama, Monog. 11, p. 31.

Hydrobius tessellatus, Horn, 1890, Trans. American Ent. Soc., 17:266, t. 4, f. 3.

Spercheus tessellatus, Schwarz and Barber, 1918, Proc. Ent. Soc. Washington, 19(1-4):135.

Hydrocyclus tessellatus, Knisch, 1921, Ent. Anz., 1:102; Knisch, 1924, Coleopterorum Catalogus, 79:176; Leng and Mutchler, 1927, Supplement to the Catalogue of the Coleoptera of America, North of Mexico, p. 19.

Hydrocyclus tessellatus, Winters, 1926, Pan-Pacific Ent., 3(2):53.

BIOLOGY

This species occurs throughout the eastern half of the United States but is considered rare. It is scarce probably because of its habitat preference which is unusual for most hydrophilids. This beetle is one of the few water scavengers that occur in a lotic habitat. It has been my experience that this species prefers the margins of cold, clear, rapidly flowing streams. Undercut gravelly and sandy stream banks with overhanging roots seem to be especially suitable. A similar habitat has been reported for this species by Leng (1913), Richmond (1920), and Young (1954). These areas are frequently overlooked by general collectors or purposely neglected because the returns, numerically speaking, are seldom rewarding.

During the summer of 1952, while attending the University of Michigan Biological Station, I found numerous larvae in association with adults in Maple River, Emmet County, Michigan. Twenty-three larvae of different instars were collected and transferred to 4-inch finger bowls in the laboratory. The bowls were partially filled with sand, tilted, and water added so that both water and moist sand were available. Records were kept of behavior, food provided, molts, and length of pupal period. Early instars were fed plankton such as *Leptodora kindti*, *Polyphemus pediculus*, *Cyclops*, *Daphnia*, *Bosmina* and other unidentified copepods and cladocerans. After a few days, plankton was discontinued in favor of larger, soft-bodied insects. Some of these were larval Dixidae, Culicidae and Chironomidae, adult Dolichopodidae, and nymphal Cercopidae and Cica-

dellidae. Occasionally, field-collected larvae devoured some of their own kind before they could be returned to the laboratory and separated.

When feeding, some larvae placed themselves with their abdomens in a vertical position along the side of the finger bowl and their thoracic regions floating on the surface with their heads and the food held up and out of the water. In this position they masticated and ingested their food. They dropped the exoskeletons of the food organisms when they finished eating. Other larvae rested their bodies on the sand but held their heads and the food in a vertical position.

Only five larvae and one pupa remained alive at the end of the summer session. These were transported by auto to the University of Kansas for further study. The specimens were examined daily while enroute. One larva died and another pupated. After arriving at the University of Kansas, one more larva pupated and the remaining two died. Of the three that pupated, one was reared to the adult stage to make sure that it was *Sperchopsis tessellatus*. Another pupa was preserved for descriptive purposes. The third pupa died and was also preserved.

Before pupation, the larvae became restless. They crawled rapidly over the sand, and food offered at this time was either completely ignored or else seized with apparent irritation. Seized food was released quickly or tossed away with a backward or sidewise snap of the head.

The last instar constructed its pupal chamber by means of undulating movements of its body which packed the moist sand and prevented collapse of the structure. One pupal chamber was 7.0 mm. high, 12.0 mm. long, and 10.0 mm. wide. No silk or other material was used to support the walls as reported by F. Balfour-Browne (1910) for *Hydrobius fuscipes*.

Several adults and one egg case of *tessellatus* were collected on April 9, 1954, in the Meramec River, 5 miles west of Steelville, Missouri. Eggs were present in the egg case which was kept for rearing purposes. Seventeen larvae hatched from the egg case but these died soon afterwards and were preserved.

Information obtained from the different rearing was pieced together and the duration of each stage was as follows: Egg to larva, 6-7 days; first instar ?; second instar ± 20 days; third instar, 54-63 days; pupal period, 6-7 days.

The duration of the third instar could have been different from that required in nature because of the following conditions: (1) Food might have been more or less readily available; (2) the transfer from a cold-water habitat to water at room temperature could have altered physiological processes; (3) the transfers from field to laboratory to car and back to the laboratory again probably were disrupting; (4) the moisture content of the sand provided for the larvae might have been undesirable. I believe the fourth condition was the major reason why the last instar was prolonged because before they would construct a pupal chamber, the larvae frequently wandered over the damp sand for a week or two until it became noticeably drier.

DESCRIPTION OF THE EGG CASE AND EGGS

The egg case (Fig. 3) is white, constructed of silk, and 6.0 mm. long, 4.0 mm. high, and 6.0 mm. wide. No mast is constructed as extensive as that found on an egg case of *Hydrobius*, although there is a marginal flap around the edge of the cap. In *Hydrobius*, the neck of the egg case is constricted, but there is only slight evidence of this in the single egg case of *Sperchopsis tessellatus* found by the author, which was collected in a net from sand beneath an overhanging stream bank. The method of attachment or placement is not definitely known but because sand grains adhered to the case, it probably was placed in the sand so that only the cap was exposed.

The eggs are white, 1.75 mm. long, and 1.0 mm. wide. They are placed on end and side by side within the case. Eyespots became noticeable in three days.

DESCRIPTION OF THE FIRST INSTAR LARVA

(FIGURE 6)

Total length 5.2 mm.; width of thorax 0.8 mm.; color whitish with light yellow-brown sclerotized areas darkening with age; integument covered with asperities (Fig. 12) arranged in irregular, short, transverse groups.

Head quadrangular (Fig. 1); 0.65 mm. wide; 0.55 mm. from labro-clypeus to occipital foramen; fronto-clypeal suture feebly indicated; frontal sutures united forming an epicranial suture; frons sagittate; cervical sclerites present, rectangular in shape. Ventral surface of head (Fig. 2) with few setae laterally, glabrous medially; with two posterior tentorial pits behind gula.

Labro-clypeus prominent (Fig. 10), slightly asymmetrical; with five teeth, central (third) one so small as to be hardly noticeable; left tooth slightly more distant from others; six setae are present, one on each side of each tooth; antero-lateral projections of epistoma equal in length to labro-clypeal teeth, rounded and with setae on anterior margin.

Ocular areas each with groups of six distinct ocelli arranged in an ellipse; anterior three larger and close to each other; posterior three smaller, one separated from other two.

Antennae short, moderately flattened, shorter than stipes; first segment constricted slightly in middle and about same size as penultimate; penultimate segment wider distally; ultimate segment very small, one-third as long as penultimate and with a distal seta.

Mandibles symmetrical, prominent, stout, sharply pointed apically, each with three well defined inner teeth and one large distal tooth, proximal one smallest, molar area rounded.

Maxillae with jointlike palpifer; stipes stout, tapering distally, bearing a row of eight stout setae on inner margin; palpifer with slender sclerotized appendage on inner side longer than first segment of palpus and with terminal seta at disto-medial angle, outer margin with two ventral setae; palpi tapering distally, first segment short, approximately one-half width of palpifer, penultimate segment tapering sharply and with apical setae.

Labium extending as far forward as palpifer; penultimate segment of palpus short, ultimate segment three to four times longer than penultimate and with apical setae; ligula distinct, twice as long as penultimate segment of palpus; palpiger subquadrate and with two setae on antero-apical angles; two long setae arising from membrane at base of ligula; mentum slightly wider than submentum, narrowing posteriorly, dorsal surface spinous and with numerous setae on anterior edge, ventrally with few setae on antero-apical angles; gula pentagonal, rounded posteriorly.

Prothorax with sides rounded, wider posteriorly; antero-lateral angle with a group of four to five large setae; postero-lateral angle with two large setae preceded by two smaller ones; sagittal line present. Prosternal sclerite large (Fig. 7), with no indication of sagittal line, subrectangular.

Mesothorax wider than prothorax but only half as long; with two small, strap-like, anterior sclerites and two large, irregularly triangular, meso-tergal sclerites; lateral margins each provided with a prominent spiracular tubercle and a setiferous lobe; sagittal line present.

Metathorax slightly wider than prothorax but about half as long; anterior metatergal sclerites larger in size, irregularly rectangular in shape; posterior sclerites small, narrow and with two tubercles each surmounted by a seta; sagittal line present.

Legs four-segmented (Fig. 13), about as long as thorax is wide; coxae moderately widely separated, transverse; trochanter about half as long as coxa; femur slightly longer than tibiotarsus; tarsal claw single, with two inner setae.

Abdomen with eight distinct segments, ninth and tenth segments reduced, terga similar and separated by an intersegmental membrane. True segmentation obscured by additional transverse folds on segments, segmental folds continued onto sternum. Each segment with four folds (Fig. 4); anterior fold with six small setose tubercles; second fold with four setose tubercles, two small, two large; third fold without tubercles; posterior fold with four small setose tubercles; outermost tubercles of second fold largest, each surmounted by a long seta. Numerous small blunt setae are present on all tubercles. A large spiracular tubercle also is present on each segment followed by a large seta-bearing tubercle. Epipleurites and hypopleurites prominently lobed. Eighth tergum represented by superior valve of stigmatic atrium which bears a large sclerite, broader than long and feebly rounded anteriorly. Ninth tergum trilobed; middle lobe large, with two setae, one on each side of median line on caudal margin; lateral lobes each with two setae, one dorsal and one ventral on middle of caudal margin.

DESCRIPTION OF THE THIRD INSTAR LARVA

Total length 15.0 mm., width 3.6 mm.; color brownish above and below, with darker brown sclerotized areas. Similar to first instar but tubercles, lobes, and setae more distinctly developed. Antennae less flattened, more cylindrical.

DESCRIPTION OF THE PUPA

(FIGURES 11, 15)

Total length 7.5 mm., width 4.0 mm.; color white except eyes reddish-brown; glabrous except for styli described below.

Head without supraorbital styli.

Pronotum with twenty-four styli as follows: three on each antero-lateral angle, two on each side of median line on anterior margin, three on each postero-lateral angle, two on each side of median line at posterior margin and two on each side of median line on disc of pronotum. Mesonotum with two styli, one stylus on each side of scutellum. Metanotum with one pair of styli.

Abdomen with four styli on first segment; second to seventh abdominal segments each with six styli arranged as follows: one stylus lateral to each abdominal spiracle, two styli between each spiracle and midline. Segment eight with four styli; segment nine with two cerci longer than width of eighth segment.

First to seventh abdominal segments with a pair of spiracles, those on segments one and seven are greatly reduced.

Antennae and legs extending outward at right angles from body axis. Tibiae of first two pairs of legs folded against femora. Tarsi turned backward parallel with body axis and widely separated. Femora and tibiae of hind legs not folded against each other. Metafemora directed obliquely away from mid-line and metatibiae directed obliquely toward mid-line. Metatarsi almost parallel with body axis and narrowly separated.

The partially developed parameres and median lobe of the male genitalia visible at the apex of the abdomen indicate that the pupa described above is a male.

The pupa usually rested in its chamber on its venter and when turned onto its dorsum for observation it would wriggle until it regained its original position. When the pupa was turned on its side for observation, it occasionally moved in a circle using its pronotal styli as a pivot and pushing with its cerci.

This genus runs to *Hydrobius* in our present keys to aquatic beetle larvae. However, it may be separated from *Hydrobius* by the following couplet:

Labro-clypeal teeth prominent, third tooth as large as other four (fig. 9); abdominal segments with minute tufts of branchiae on mid-line (fig. 5), laterally on tuberculate areas and ventrally; prosternal sclerite divided by a sagittal line (fig. 8); asperities in short transverse rows (fig. 14)-----	HYDROBIUS
Labro-clypeal teeth prominent except third which is minute, less than half as long as adjacent teeth (fig. 10); abdominal segments without tufts of branchiae (fig. 4); prosternal sclerite not divided by a sagittal line (fig. 7); asperities irregular (fig. 12) -----	SPERCHOPSIS

DISTRIBUTION

A total of 268 specimens were examined from the following localities: ALABAMA: Mobile; Oneonta. ARKANSAS: Washington Co. CONNECTICUT: Cornwall; Cos Cob; Fairfield Co. FLORIDA: Centreville; Defuniak Springs. GEORGIA: Chatooga River, Pine Mt. ILLINOIS: no additional data. INDIANA: Lake Co.;

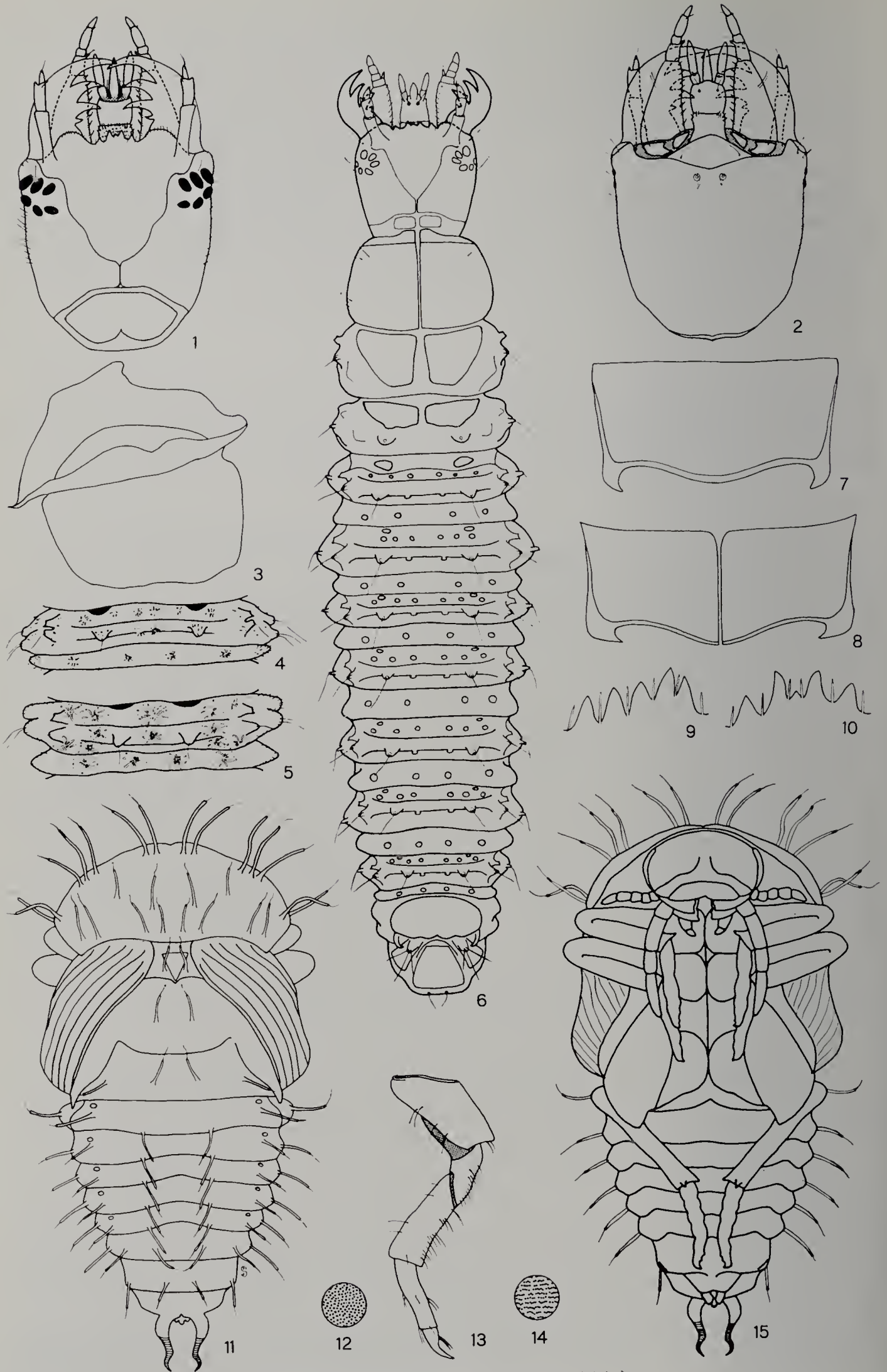
Tippecanoe Co.; White River, Rogers. MARYLAND: Baltimore; Beltsville; Bladensburg; Clinton. MASSACHUSETTS: Fall River; South Hadley, Fairfield Lake. MICHIGAN: Cheboygan Co.; Douglas Lake; Emmet Co.; Free Soil, Great Sable River; Gd. Ledge; Marquette; Merriweather, Merriweather Cr.; Oakland Co.; Ogemaw Co., Houghton Creek; Pentwater. MISSISSIPPI: Avera; Clara; Columbus, Camp Pratt; Lucedale. MISSOURI: Eminence, Shawnee Creek; Steelville, Meramec River, NEW JERSEY: Atco; Clementon; Eatontown; Highlands; Hillsdale; Lahaway; Montvale; Pollersville; Spotswood; Westwood. NEW YORK: New York City, Clason Point; Warren Co.; Washington Co. NORTH CAROLINA: Reidsville. OHIO: Millersburg, Holmes Co. PENNSYLVANIA: Bethlehem; Pittsburgh. SOUTH CAROLINA: Blackwater, Edisto Exp. Sta.; Clemson College (at light). VERMONT: Brattleboro. VIRGINIA: Fredericksburg; Mt. Vernon. WISCONSIN: Millston. NOVA SCOTIA: S. Millford. QUEBEC: Kazubazua.

SELECTED BIBLIOGRAPHY

- BALFOUR-BROWNE, FRANK, 1910. On the life-history of *Hydrobius fuscipes* L. Trans. Roy. Soc. Edinburgh, vol. XLVII, part 2, No. 14, pp. 317-340.
- HORN, GEORGE, 1873. Revision of the tribe Hydrobiini. Proc. American Phil. Soc., vol. XIII, pp. 132, 133.
- KNISCH, ALFRED, 1921. Über die Gattung *Hydrocylus* Sharp (Coleoptera: Hydrophilidae op. 9). Ent. Anzeiger, Jahrg. 1, Nr. 8, pp. 100-107.
- LECONTE, JOHN L., 1862. Classification of the Coleoptera of North America, Part 1. Smithson. Misc. Coll., No. 3, 1861, pp. xxv + 208, figs. (pp. 209-286 were published in 1862 and pp. 43-48 were emended in March, 1862).
- LENG, CHARLES W., 1913. Aquatic Coleoptera. Jour. New York Ent. Soc., vol. XXI, No. 1, pp. 32-42.
- D'ORCHYMONT, ARMAND, 1928. Catalog of Indian insects, part 14-Palpicornia. Government of India, Central Publication Branch, Calcutta, India, pp. 1-146.
- D'ORCHYMONT, ARMAND, 1942. Contribution a l'étude de la tribu Hydrobiini Bedel, spécialement de sa sous-tribu Hydrobiae (Palpicornia-Hydrophilidae). Mem. Mus. roy. Hist. nat. Belgique, 23rd Ser., fasc. 24, pp. 1-68.
- RICHMOND, E. AVERY, 1920. Studies on the biology of the aquatic Hydrophilidae. Bull. American Mus. Nat. Hist., vol. XLII, Art. 1, pp. 1-94.
- SCHWARZ, E. A., and H. S. BARBER, 1918. Two new hydrophilid beetles. Proc. Ent. Soc. Washington, vol. XIX, no. 1-4, pp. 129-135.
- WINTERS, FRED C., 1926. Notes on the Hydrobiini (Coleoptera: Hydrophilidae) of Boreal America. Pan-Pacific Ent., vol. II, no. 2, pp. 49-58.
- YOUNG, FRANK N., 1954. The water beetles of Florida. Univ. Florida Studies Biol. Sci. Ser., vol. V, no. 1, pp. x + 238.
- ZIEGLER, DANIEL, 1844. Descriptions of new North American Coleoptera. Proc. Acad. Nat. Sci. Philadelphia, vol. II, pp. 43-47.

Sperchopsis tessellatus: FIG. 1, head capsule, dorsal view; FIG. 2, head capsule, ventral view; FIG. 3, egg case; FIG. 4, first abdominal segment, dorsal view; FIG. 6, larva, dorsal view; FIG. 7, prosternum; FIG. 10, labro-clypeus; FIG. 11, pupa, dorsal view; FIG. 12, arrangement of tergal asperities on first abdominal segment; FIG. 13, right prothoracic leg; FIG. 15, pupa, ventral view.

Hydrobius globosus: FIG. 5, first abdominal segment, dorsal view; FIG. 8, prosternum; FIG. 9, labro-clypeus; FIG. 14, arrangement of tergal asperities on first abdominal segment.



(See caption, bottom of page 111.)